so that if it be desired to exhaust the air from any vessel it will only be necessary to connect it with one of these pipes and *turn on a vacuum*. If a more perfect vacuum be desired than can be obtained by this means, the vessel may be subsequently exhausted by the Sprengel or other air-pump. A metal tube filled with mercury, with glass gauges on every floor for observing the height of the mercury within, will extend throughout the whole height of the tower and will serve as a manometer. The lower end of the tube will pass through the wall and terminate in F Fig. 1. On the top of the tower will be fixed a wooden mast carrying a pointed metal rod, for the purpose of collecting atmospheric electricity. The rod will communicate with the interior of the laboratory by an insulated wire.

The floors of the building are liberally supplied with hatches about 8 in. square, and in most cases those in the first floor are placed vertically under those in the second floor, so that wires may be suspended through the whole height of the building.

The laboratory was designed by Mr. W. M. Fawcett, M.A., of Jesus College, and the way in which he has turned to account the space available for his purpose, as well as the simple beauty of his designs have been the subjects of great admiration. Loveday of Kibworth was the contractor.

After the congregation on the 16th the Duke of Devonshire, Sir Bartle Frere, Sir Garnet Wolseley, Prof. Stoletow of Moscow, Prof. Balfour Stewart, Prof. Roscoe, and other distinguished visitors inspected the laboratory and expressed great satisfaction with the building and the arrangements.

Amongst the apparatus at present in the laboratory besides the electro-dynamometer of the British Association, may be mentioned the original B.A. units of resistance, together with the rotatory coil, speed governor, and bridge used in their construction; Sir William Thomson's quadrant electrometer, resistance coils up to 100,000 ohms (a megohm as well as some coils of very small resistance are expected shortly), three mirror galvanometers of different constructions, a 3 ft. 6 in. glass plate electric machine, and a 30 in. ebonite electric machine, Holtz's electric machine, and a hydraulic press, of a peculiar construction, made by Ladd and Co.

THE "CHALLENGER" IN THE SOUTH ATLANTIC

AT the last meeting of the Royal Society a letter from Prof. Wyville Thomson on board H.M.S. *Challenger*, to Admiral Richards, was read, which contained results of such high importance to biological science that were it the only result of the expedition England might have been proud to have had a hand in it. It is most interesting too as carrying on the story of the daily life on board ship which has been touched upon by Prof. W. Thomson in former communications to NATURE. The letter, which is dated Melbourne, March 17, starts by telling us that south of the line observations in matters bearing upon Prof. Thomson's department were made most successfully at nineteen principal stations, suitably distributed over the track, and including Marion Island, the neighbourhood of the Crozets, Kerguelen Island, and the Heard group.

After leaving the Cape, several dredgings were taken a little to the southward, at depths from 100 to 150 fathoms. Animal life was very abundant; and the result was remarkable in this respect, that the general character of the fauna was very similar to that of the North Atlantic, many of the species even being identical with those on the coasts of Great Britain and Norway.

Marion Island was visited for a few hours, and a considerable collection of plants, including nine flowering species, was made by Mr. Moseley. A shallow-water dredging near Marion Island gave a large number of species, again representing many of the northern types, but with a mixture of southern forms, such as many of the characteristic southern Bryozoa and the curious genus *Serolis* among Crustaceans. Off Prince Edward's Island the dredge brought up many large and striking specimens of one or two species of Alcyonarian zoophytes, allied to *Mopsea* and *Isis*.

The trawl was put down in 1,375 fathoms on Dec. 29, and in 1,600 fathoms on the 30th, between Prince Edward's Island and the Crozets. The number of species taken in these two hauls was very large, and many of them belonged to especially interesting genera, while many were new to science. There occurred, with others, the well-known genera *Euplectella*, *Hyalonema*, *Umbellularia*, *Flabellum*, two entirely new genera of stalked Crinoids belonging to the Apiocrinidæ, *Pourtalesia*, several Spatangoids new to science, allied to the extinct genus *Ananchytes*, *Salenia*, several remarkable Crustaceans, and a few fish.

The *Challenger* reached Kerguelen Island on Jan. 7, and remained there until Feb. 1. During that time Dr. von Willemoes-Sühm was chiefly occupied in working out the land-fauna, Mr. Moseley collected the plants, Mr. Buchanan made observations on the geology of those parts of the island which were visited, and Mr. Murray and Prof. Thomson carried on the shallow-water dredging in the steam-pinnace. Many observations were made, and large collections were stored.

Two days before the expedition left Kerguelen Island they trawled off the entrance of Christmas harbour, and the trawl-net came up on one occasion nearly filled with large cup-sponges belonging to the genus *Rossella* of Carter, and probably the species dredged by Sir James Clark Ross near the ice-barrier, *Rossella antarctica*.

The *Challenger* reached Corinthian Bay in Yong Island on the evening of the 6th, and all arrangements had been made for examining it, as far as possible, on the following day; but a sudden change of weather obliged Capt. Nares to put to sea. Fortunately Mr. Moseley and Mr. Buchanan accompanied Capt. Nares on shore for an hour or two on the evening of their arrival, and took the opportunity of collecting the plants and minerals within their reach.

The most southerly station was made on Feb. 14, lat. 65° 42′ S., long. 79° 49′ E. The trawl brought up, from a depth of 1,675 fathoms, a considerable number of animals, including Sponges, Alcyonarians, Echinids, Bryozoa, and Crustacea, all much of the usual deep-sea character, although some of the species had not been previously observed.

Prof. Thomson gives a list of the various classes of animals from Sponges to Teleostei, that were met with in nine successful dredgings, at depths beyond 1,000 fathoms, between the Cape and Australia. Many of them, Prof. Thomson states, are new to science, and some are of great interest from their relation to groups supposed to be extinct. This is particularly the case with the Echinodermata, which are here, as in the deep water in the north, a very prominent group.

During the present cruise special attention has been paid to the nature of the bottom, and to any facts which might throw light upon the source of its materials. This department has been chiefly in the hands of Mr. Murray; and Prof. Thomson gives the following extracts from Mr. Murray's notes:—

"In the soundings about the Angulhas bank, in 100 to 150 fathoms, the bottom was of a greenish colour, and contained many crystalline particles (some dark-coloured and some clear) of Foraminifera, species of *Orbulina*, *Globigerina*, and *Pulvinulina*; a pretty species of *Uvigerina*, *Planorbulina*, *Miliolina*, *Bulimina*, and *Nummulina*. There were very few Diatoms.

"In the deep soundings and dredgings before reaching the Crozets, in 1,900, 1,570, and 1,375 fathoms, the bottom was composed entirely of *Orbulina*, *Globigerina*, and *Pulvinulina*, the same species which we get on the surface, but all of a white colour and dead. Of Foraminifera, which we have not got on the surface, I noticed one *Rotalia* and one *Polystomella*, both dead. Some Coccoliths and Rhabdoliths were also found in the samples from these soundings. On the whole, these bottoms were, I think, the purest carbonate of lime we have ever obtained. When the soundings were placed in a bottle, and shaken up with water, the whole looked like a quantity of sago. The *Pulvinulinæ* were smaller than in the dredgings in the Atlantic. We had no soundings between the Crozets and Kerguelen.

"The specimens of the bottom about Kerguelen were all from depths from 120 to 20 fathoms, and consisted usually of dark mud, with an offensive sulphurous smell. Those obtained farthest from land were made up almost entirely of matted sponge-spicules. In these soundings one species of *Rotalina* and one other Foraminifera occurred.

"At 150 fathoms, between Kerguelen and Heard Island, the bottom was composed of basaltic pebbles. The bottom at Heard Island was much the same as at Kerguelen. The sample obtained from a depth of 1,260 fathoms, south of Heard Island, was quite different from anything we had previously obtained. It was one mass of Diatoms, of many species, and mixed with these a few small Globigerinæ and Radiolarians, and a very few crystalline particles.

"The soundings and dredgings while we were among the ice in 1,675, 1,800, 1,300, and 1,975, gave another totally distinct deposit of yellowish clay, with pebbles and small stones, and a considerable admixture of Diatoms, Radiolarians, and Globigerinæ. The clay and pebbles were evidently a sediment from the melting icebergs, and the Diatoms, Radiolarians, and Foraminifera were from the surface-waters.

"The bottom, from 1,950 fathoms, on our way to Australia from the Antarctic, was again exactly similar to that obtained in the 1,260 fathoms sounding south of Heard Island. The bottom at 1,800 fathoms, a little farther to the north (lat. 50° 1′ S., long. 123° 4′ E.), was again pure 'Globigerina-ooze,' composed of *Orbulinæ*, *Globigerinæ*, and *Pulvinulinæ*.

"The bottom at 2,150 fathoms (lat. 47° 25′ S., long. 130° 32′ E.) was similar to the last, with a reddish tinge, and that at 2,600 fathoms (lat. 42° 42′ S., long. 134° 10′ E.) was reddish clay, the same which we got at like depths in the Atlantic, and contained manganese nodules and much decomposed Foraminifera."

Mr. Murray, Prof. Thomson goes on to say, "has been induced by the observations which have been made in the Atlantic, to combine the use of the towing-net at various depths from the surface to 150 fathoms, with the examination of the samples from the soundings. And this double work has led him to a conclusion (in which I am now forced entirely to concur, although it is certainly contrary to my former opinion) that the bulk of the material of the bottom in deep water is in all cases derived from the surface.

"Mr. Murray has demonstrated the presence of Globigerinæ, Pulvinulinæ, and Urbulinæ throughout all the upper layers of the sea over the whole of the area where the bottom consists of 'Globigerina-ooze' or of the red clay produced by the decomposition of the shells of Foraminifera; and their appearance when living on the surface is so totally different from that of the shells at the bottom, that it is impossible to doubt that the latter, even although they frequently contain organic matter, are all dead. I mean this to refer only to the genera mentioned above, which particularly form the ooze. Many other Foraminifera undoubtedly live in comparatively small numbers, along with animals of higher groups, on the bottom."

It is very curious to note that in the extreme south the conditions were so severe as greatly to interfere with all work. "We had," Prof. Thomson says, "no arrangement for heating the work-rooms, and at a temperature which averaged for some days 25° F. the instruments became so cold that it was unpleasant to handle them, and the vapour of the breath condensed and froze at once upon glass and brass work. Dredging at the considerable depths which we found near the Antarctic circle became a severe and somewhat critical operation, the gear being stiffened and otherwise affected by the cold, and we could not repeat it often.

"The evening of Feb. 23 was remarkably fine and calm, and it was arranged to dredge on the following morning. The weather changed somewhat during the night, and the wind rose. Captain Nares was, however, most anxious to carry out our object, and the dredge was put over at 5 A.M. We were surrounded by icebergs, the wind continued to rise, and a thick snow-storm came on from the south-east. After a time of some anxiety the dredge was got in all right; but, to our great disappointment, it was empty—probably the drift of the ship and the motion had prevented its reaching the bottom. In the meantime the wind had risen to a whole gale, force = 10 in the squalls, the thermometer fell to 21°·5 F., the snow drove in a dry blinding cloud of exquisite star-like crystals, which burnt the skin as if they had been red hot, and we were not sorry to be able to retire from the dredging-bridge.

"The specific gravity of the water has been taken daily by Mr. Buchanan; and during the trip Mr. Buchanan has determined the amount of carbonic acid in 25 different samples—15 from the surface, 7 from the bottom, and 2 from intermediate depths. The smallest amount of carbonic acid was found in surface-water on Jan. 27, near Kerguelen; it amounted to 0·0373 gramme per litre. The largest amount, 0·0829 gramme per litre, was found in bottom-water on Feb. 14, when close to the Antarctic ice. About the same latitude the amount of carbonic acid in surface-water rose to the unusual amount of 0·0656 gramme per litre; in all other latitudes it ranged between 0·044 and 0·054 gramme per litre. From the greater number of these samples the oxygen and nitrogen were extracted, and sealed up in tubes.

"While we were among the ice all possible observations were made on the structure and composition of icebergs. We only regretted greatly that we had no opportunity of watching their birth, or of observing the continuous ice-barrier from which most of them have the appearance of having been detached. The berg- and floe-ice was examined with the microscope, and found to contain the usual Diatoms. Careful drawings of the different forms of icebergs, of the positions which they assume in melting, and of their intimate structure, were made by Mr. Wild, and instantaneous photographs of several were taken from the ship.

"I need only further add that, so far as I am able to judge, the expedition is fulfilling the object for which it was sent out. The naval and the civilian staff seem actuated by one wish to do the utmost in their power, and certainly a large amount of material is being accumulated.

"The experiences of the last three months have, of course, been somewhat trying to those of us who were not accustomed to a sea-life; but the health of the whole party has been excellent. There has been so much to do that there has been little time for weariness; and the arrangements continue to work in a pleasant and satisfactory way."

COLONIAL GEOLOGICAL SURVEYS

I.—CANADA

Report of Geological Survey of Canada for 1872-73.

RATHER less than thirty years ago the Canadian Legislature passed a vote for the institution of a Geological Survey of the province, with the object of ascertaining definitely the mineral resources of the country. In pursuance of this decision, the Governor-General, after some inquiry about a properly qualified individual to take charge of the Survey, finally appointed Mr. W. E. Logan, who, born in Canada, had made his name known in England by some careful surveys of the South Welsh Coalfield, and by original observations on the origin of coal. For thirty long years of unremitting labour, with obstacles of every kind, physical, pecuniary, political, the brave and sagacious director stuck to his post. Many a time with a legislature impatient for practical results in the discovery of minerals, and a ministry indifferent to science and bent on popularity by retrenchment of the budget, the chances of the Canadian Survey seemed desperate. But the pilot who guided its destinies showed himself as shrewd a judge of men, and as able to win them over, as he was a skilful pioneer in geology. And the result is that he has made the Canadian Geological Survey one of the first in the world, excellent in its equipment, considering the slender means placed at his disposal, and altogether admirable for the vast amount of solid work which it has accomplished—work which has not merely been of service to Canada, but has acquired a world-wide interest. In doing this he has made his own name a household word among geologists of every country. Canada may well be proud of her Sir William Logan.

About four years ago, having toiled so long and hard, he felt compelled to relinquish his post and seek the rest which his old age so needed and deserved. He was succeeded by Mr. Alfred R. Selwyn, who had been trained in the early days of the Geological Survey under Sir Henry De la Beche, had done much excellent and difficult geological work in Wales, and had thereafter held for a number of years the post of Director of the Geological Survey of Victoria. The Victorian authorities in 1869 suppressed their survey. When Mr. Selwyn lost that appointment, he was induced to accept the guidance of the establishment in Canada. There could hardly have been found a fitter successor to Sir William Logan. Long experience in all the details of geological surveying, both in civilised and in still unexplored regions, must have made it an easy matter for Mr. Selwyn to adapt himself to Canadian modes of exploration. He was renowned in his old Welsh days for his prowess as a mountaineer, and to judge from the present report the advance of years has not perceptibly impaired his bodily activity and powers of endurance. During the comparatively brief season when geological reconnaissances are possible in British North America he is found at one time away in the far east of the dominion inspecting mines in Nova Scotia, at another time with his colleagues and Indians laboriously toiling through river, lake, and portage, in the still only partially explored regions towards Fort Garry, or camping out for many weeks on the shores of Lake Superior. During 1872 the operations of the Canadian Survey under his charge extended across the whole breadth of North America at its broadest part, that is from the Queen Charlotte Islands to the headlands of Nova Scotia—a distance, in a straight line, of considerably more than 3,000 miles.

The success of such a service as that of the Canadian Geological Survey must depend, however, in large part on the calibre of the men who act under the director. And Mr. Selwyn is fortunate in his staff, which is nearly the same as that under Sir William Logan. Of his explorers in the field Mr. R. Bell and Mr. James Richardson have done much of that sound work on which the reputation of the Canadian Survey rests. To Mr. Billings, who determines his fossils, and to Dr. Dawson, who, though not attached to the Survey, generously lends his assistance in the palæontological department, the Survey is likewise largely indebted. As an analyst of minerals and ores and an able writer on chemical geology Sir William Logan had a tower of strength in Dr. Sterry Hunt, who has lately accepted an appointment in the United States. Dr. Hunt's successor, Dr. Harrington, carries with him into his new duties the good wishes of all geologists who take